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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/988,387	11/19/2001	Paul Van Der Veen	P 284021 P-0217.010-US	8241

909 7590 02/25/2004

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EXAMINER	
JOHNSTON, PHILLIP A	

ART UNIT	PAPER NUMBER
2881	

DATE MAILED: 02/25/2004

Please find below and/or attached an Office communication concerning this application or proceeding.

PTO-90C (Rev. 10/03)

Office Action Summary	Application No.	Applicant(s)	
	09/988,387	VAN DER VEEN, PAUL	
	Examiner	Art Unit	
	Phillip A Johnston	2881	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on 22 December 2003.

2a)☒ This action is **FINAL**. 2b)☐ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) 1-14 is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) 1-14 is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☒ All b)☐ Some * c)☐ None of:

1.☒ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☐ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: _____.

Detailed Action

1. The following is a response to Applicants Amendment dated 12-22-2003

Claims Rejection – 35 U.S.C. 103

1. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which the subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

2. Claims 1-14 stand rejected under 35 U.S.C. 103(a) as being unpatentable over U.S. Patent No. 6,369,398 to Gelernt, in view of Kleinschmidt, U.S. Patent No. 6,160,832 and in further view of Makinouchi, U.S. Patent No. 6,490,025.

Gelernt (398) discloses a lithographic system used in the fabrication of integrated circuits (IC). A source of radiation 110 exposes a radiation sensitive material 160, known as a resist that has been coated on the substrate surface 180. The resist 160 is typically a polymeric material, which undergoes structural or chemical changes upon exposure to the incident radiation. The incident radiation, which is typically of narrow bandwidth, is either provided by conventional light sources such as a mercury lamp, or excimer laser systems such as krypton fluoride (KrF) or argon fluoride (ArF).

For example, the bandwidth of the incident radiation may be controlled by the use of an appropriate filter 115. A mask 130, or reticle, is positioned between the light source 110 and the substrate 180 containing the resist layer 160. A typical optical imaging system for photolithography comprises a lens component 120 used to collimate the light, or radiation, to illuminate the mask 130. The light, which is transmitted through the mask 130 is subsequently focused by additional imaging optics 140 onto the resist layer 160. The mask 130 contains regions such as 130a that transmit the radiation and regions 130b that block the radiation. A typical mask, for example, consists of a chrome pattern (corresponding to a circuit pattern) that has been formed over a quartz substrate 132. While quartz is transparent to the incident radiation, the chrome pattern prevents the radiation from reaching the resist layer 160. For example, this lithographic exposure step may render the exposed resist region soluble to a chemical in a subsequent developing step, and allows the circuit pattern to be transferred to the resist layer. See Column 1, line 31-59.

Gelernt (398) as applied above does not disclose the use of an acoustic sensor to detect sounds caused by the passage of pulses of radiation of the projection system, as recited in Claim 1. However, Kleinschmidt (832) discloses a laser calibration system for lithography that utilizes a microphone for photoacoustic detection. Figure 1a shows the ArF-excimer laser chamber 1 emitting around 193 nm, surrounded by various optical and electrical components. The laser chamber 1 normally has tilted windows, e.g., at Brewster's angle. The laser system includes a resonator comprising a highly reflective mirror 10, a polarizer 13, a beam splitter 9a

and a wavelength narrowing and tuning block 5. The system further includes a wavelength calibration system including a wavelength calibration module 2 (galvatron). See Column 4, line 41-52.

Kleinschmidt (832) also discloses, that the galvatron may be used in a different way as shown in FIG. 1b, wherein FIG. 1b includes the setup of FIG. 1a and additionally includes a photodetector arranged near the galvatron. In the system of FIG. 1b, the galvatron serves as a module 2 filled with the element 21 in gaseous form, as described above. The gaseous element 21 may be caused to fill the galvatron by forming the cathode 22 of the galvatron out of the element 21 in solid form, and running a current between the anode 23 and the cathode 22 of sufficient amplitude to sublimate the element 21.

The voltage across the anode and cathode are not monitored in the system of FIG. 1b, as they are with the system of FIG. 1a (i.e., for the purpose of detecting energy level resonances in species of the element 21 induced by the incident light). Instead, the intensity of the light as it passes through the galvatron is detected. By so doing, absorption lines of the element 21 are detected when the detected intensity is reduced below that which is expected at the wavelengths corresponding to the absorption lines. Since the absolute wavelengths of photoabsorption are known for the element 21, the absolute wavelength of the laser light is determinable. See Column 5, line 52-67; and Column 6, line 1-6.

Kleinschmidt (832) further discloses a variation of the techniques described above with respect to FIGS. 1a, 1b and 9 is the following. Instead of using the

optogalvanic effect, or measuring the absorption through the gas of the module using, e.g., a photodiode or photomultiplier tube, a microphone for photoacoustic detection may be used. The rest of the preferred method and apparatus is the same as described above. See Column 10, line 59-65.

Therefore it would have been obvious to one of ordinary skill in the art that Gelernt's (398) lithographic exposure system can be modified to use the acoustic detection apparatus and method in accordance with Kleinschmidt (832), to measure the intensity of the laser lithographic radiation source.

Regarding Claim 5, Gelernt (398) in view of Kleinschmidt (832) discloses a lithographic exposure system that utilizes an acoustic sensor, but does not disclose the use of a vibration sensor mechanically coupled to an object on which the projection beam is incident. However, Makinouchi (025); discloses an exposure apparatus for projecting an image pattern on a mask onto a photosensitive substrate, including: a body including a projecting optical system through which the image pattern is projected from the mask to the photosensitive substrate; a first stage movable to the body and adapted to mount the mask; a second stage movable to the body and adapted to mount the photosensitive substrate; a measuring device for measuring the position of either one of the mask mounted on the first stage and the photosensitive substrate mounted on the second stage; a vibration sensor for measuring vibration of the body; and a position controller for controlling the position of either one of the mask mounted on the first stage and the photosensitive substrate mounted on the second

stage based on a measurement value of the vibration sensor and a measurement value of the measuring device. See Abstract.

Therefore it would have been obvious to one of ordinary skill in the art that the lithographic of Gelernt (398) in view of Kleinschmidt (832) can be modified to use the vibration detection apparatus and method of Makinouchi (025) to detect vibration on the substrate, as recited in Claim 5.

Examiners Response to Arguments

4. Applicant's arguments filed 12-22-2003 have been fully considered but they are not persuasive.

Argument 1.

Applicant states that " Kleinschmidt et al. simply uses a microphone for wavelength calibration of a laser. Kleinschmidt et al. does not disclose, teach or suggest anywhere using a microphone to detect sounds caused by the passage of a projection beam in a lithographic apparatus."

The applicant is respectfully directed to Kleinschmidt (832), Column 1, line 20-28, which states; Excimer lasers emitting pulsed UV-radiation are becoming increasingly important instruments in specialized material processing. The KrF-excimer laser emitting around 248 nm and the ArF-excimer laser emitting around 193 nm are rapidly

becoming the light sources of choice for photolithographic processing of integrated circuit devices (IC's). The F_2 -laser is also being developed for such usage and emits light around 157 nm.

The applicant is also respectfully directed to Kleinschmidt (832), Column 3, line 31-46, which states; The present invention further encompasses the above desired features and others by preferably providing a galvatron having a cathode and an anode as the wavelength calibration module. Preferably, the narrowed emission is directed toward the galvatron and voltage changes are detected between the cathode and anode of the galvatron due to opto-galvanic resonance effects when the narrowed emission is tuned within the broadband ArF-excimer laser emission spectrum or within the F_2 -laser emission spectrum. Alternatively, a photodetector is aligned to monitor the intensity of light traversing the gaseous medium of the galvatron as the wavelength of the light in tuned; the detected intensity showing marked reduction around absorption-transition lines of the gaseous medium. The absolute wavelength of the narrowed emission is then precisely determined anywhere within the broadband spectrum.

The applicant is further respectfully directed to Kleinschmidt (832), Column 10, line 59-67; and Column 11, line 1-13, which states; A variation of the techniques described above with respect to FIGS. 1a, 1b and 9 is the following. Instead of using the optogalvanic effect, or measuring the absorption through the gas of the module using, e.g., a photodiode or photomultiplier tube, a microphone for photoacoustic

detection may be used. The rest of the preferred method and apparatus is the same as described above.

In addition, when the photoabsorption intensity is generally low, such as when a weak absorption line is used in any of the above techniques, the beam portion may be directed to pass through the gas of the calibration module 2 more than once, such as by an arrangement of mirrors and/or beam splitters BS1-BS5 such as are shown in FIG. 10. Any of optogalvanic, photoabsorption and photoacoustic detection techniques described above may be performed using this technique to enhance the detected signal intensity. When the photoabsorption technique is used, a portion of the split off beam can be output to a detector 25' positioned not to interfere with the cycling beam. Of course a processor receives the optogalvanic, photoabsorption or photoacoustic detection information and controls the laser wavelength accordingly.

Argument 2.

Applicant also states that "There is no suggestion in either Gelernt or Kleinschmidt that the lithographic exposure system of Gelernt can be modified to use an acoustic detection device in accordance with Kleinschmidt et al. Furthermore, one of ordinary skill in the art would not have been motivated to use a microphone as disclosed in Kleinschmidt, i.e., merely for wavelength calibration, in the lithographic apparatus of Gelernt to detect radiation of the projection beam."

Applicant is respectfully directed to Gelernt (398), which states; Using the method of the present invention, one selects the lithographic exposure wavelength so as to minimize intensity attenuation due to air absorption. As shown in FIG. 2b, the

absorption coefficient of O_2 at the wavelength region indicated by the arrow 12a is approximately 1.5 $atm^{-1}cm^{-1}$, which is about two orders of magnitude lower than that of about 200 atm^{-1} cm^{-1} at the F_2 laser wavelength of 157 nm. The practical implication is that if lithography is performed at an irradiating wavelength around that indicated by the arrow 12a, the otherwise stringent requirement for a high vacuum or inert gas purge system can be relaxed. That is, a reduced pump-down or purging cycle time can be realized in the lithographic tool, leading to an improvement in the process throughput. Therefore, the use of lithographic exposure at wavelengths illustrated by the arrows in FIGS. 2a-2c represents an improved approach to VUV lithography.

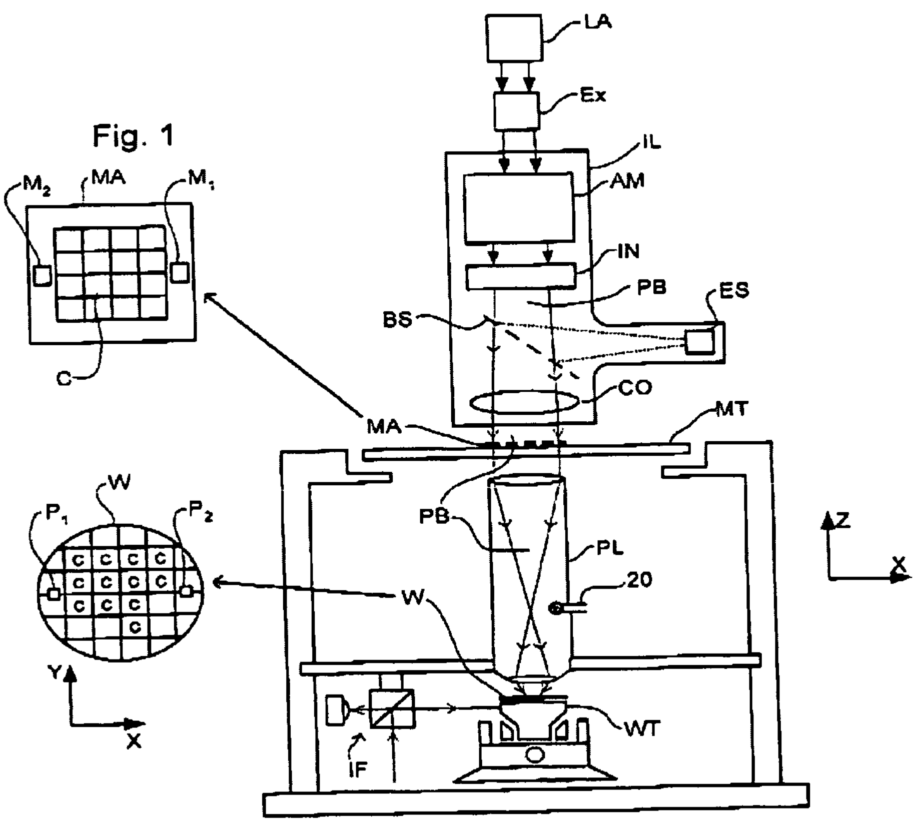
In response to Applicant's argument that there is no suggestion to combine the references, the Examiner recognizes that references cannot be arbitrarily combined and that there must be some reason why one skilled in the art would be motivated to make the proposed combination of primary and secondary references. In re Nomiya, 184 USPQ 607 (CCPA 1975). However, there is no requirement that a motivation to make the modification be expressly articulated. The test for combining references is what the combination of disclosures taken as a whole would suggest to one of ordinary skill in the art. In re McLaughlin, 170 USPQ 209 (CCPA 1971) references are evaluated by what they suggest to one versed in the art, rather than by their specific: disclosures. In re Bozek, 163 USPQ 545 (CCPA 1969). In this case, the examiner has interpreted from the Gelernt (398) and Kleinschmidt (832) references above, that wavelength calibration and control of a laser source in accordance with Kleinschmidt (832) is important to Gelernt (398), which can help improve lithography.

Argument 3

The Applicant states "Makinouchi does not disclose, teach or suggest to measure acoustic vibrations caused by the passage of radiation pulses."

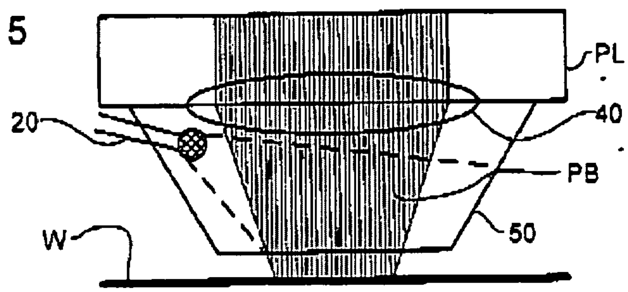
The applicant is also respectfully directed to Applicants Specification Page 9, line 15, which states; In Figure 1 an acoustic sensor 20 is provided in a space comprised by the projection system PL to detect sounds caused by the passage of pulses of radiation of the projection beam PB.

And Fig. 1, below;



Also Page 11, line 5-9, which states; A second embodiment of the present invention, which may be the same as the first embodiment save as described below, is shown in FIG. 5. The microphone (or micro-barograph) 20 is located in a chamber 50 mounted to the projection system PL below the element 40 directly opposite the wafer W; an element such as element 40 may be referred to hereinafter as the "final" element.

Fig. 5



The applicant is also respectfully directed to Makinouchi (025), Column 5, line 29-35, which states; Moreover; in this embodiment, an acceleration sensor (an acceleration meter) 50 serving as the vibration sensor is provided on the side surface of the projection optical system PL. The vibrations of the projection optical system PL is measured by the acceleration sensor 50, and the measurement values relating to the vibrations are supplied to the main control system 18.

And Figure 1, below;

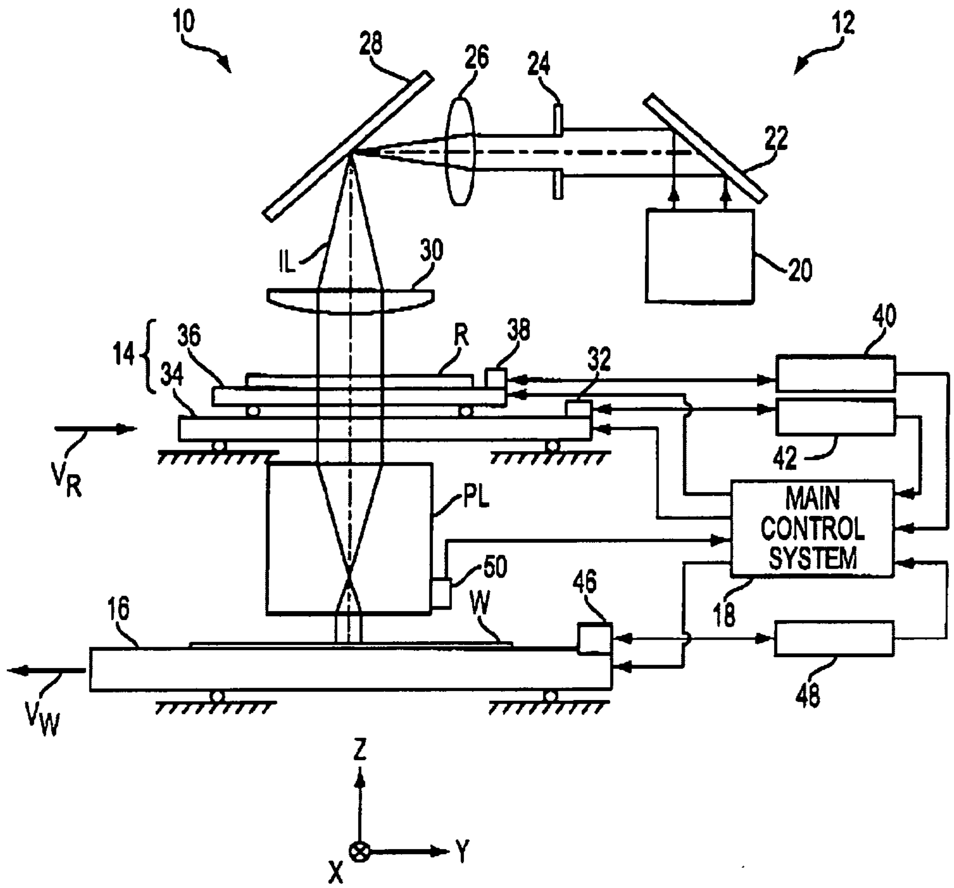


FIG. 1

The examiner has interpreted from the Applicants Specification and the Makinouchi (025) references above, that the use of a vibration sensor in accordance with Makinouchi (025), is equivalent to the use of a vibration sensor, as recited in Claim 5.

Conclusion

5. The Amendment filed on 12-22-2003 under 37 CFR 1.131 has been considered but is ineffective to overcome the Kleinschmidt (832) and Makinouchi (025) references.

THIS ACTION IS MADE FINAL. Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the mailing date of this final action.

6. Any inquiry concerning this communication or earlier communications should be directed to Phillip Johnston whose telephone number is (571) 272-2475. The examiner can normally be reached on Monday-Friday from 7:30 am to 4:00 pm. If attempts to reach the examiner by telephone are unsuccessful, the examiners supervisor John Lee can be reached at (571) 272-2477. The fax phone numbers are (703) 872-9318 for regular

response activity, and (703) 872-9319 for after-final responses. In addition the customer service fax number is (703) 872- 9317.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is 703 308 0956.

PJ
February 10, 2004

JOHN R. LEE
SUPERVISORY PATENT EXAMINER
TECHNOLOGY CENTER 2800